Death ray or ray of hope?

The Incredible Laser

Here's an exciting report on science's new "Aladdin's lamp." It can light up the moon, kill instantly or perform miracle surgery

By STUART H. LOORY

IN A LABORATORY at Schenectady, N.Y., a group of General Electric engineers recently pointed a basketball-size instrument at a diamond, pulled the trigger and burned a hole right through the diamond in two hundred millionths of a second.

At Lexington, Mass., a group of scientists from M.I.T. and the Raytheon Co. pointed the same type of device at the darkened moon. The resulting flash illuminated a two-mile circle on the moon's surface as easily as switching on a lamp.

This new scientific tool has been named the "laser" (rhymes with razor). Scientists say it gives off "coherent light waves." Military men describe it as producing "focused energy," and foresee its use to track and instantly destroy enemy missiles headed toward the U.S.

The laser may have greater impact than any discovery so far in the burgeoning field of electronics, which has already brought us radar, transistors, satellite tracking networks, TV. The technological revolution it brings about may dwarf any in the past.

What does "laser" mean?

What exactly is a laser and what does it do? The word is made up of the initial letters of "Light Amplification by Stimulated Emission of Radiation." In ordinary light, atoms emit their rays haphazardly in all directions. What the laser does is to force the atoms to emit their radiation in phase, so that a very narrow beam of extremely high intensity results. Focus this beam, and it will carry super-potent light vast distances.

At the core of this modern "Aladdin's lamp" is either a rod of man-made ruby or a tube filled with one of the inert gases such as helium or krypton. The Aladdins who are busily rubbing this "lamp" are more than two thousand scientists working in 400 laboratories across the country. Part of their aim is to fit the laser into weapons systems, for there is little doubt of its enormous and versatile military potential.

Energy with the speed of light

General Curtis E. LeMay, Air Force Chief of Staff, believes the laser may serve to restore the balance between offense and defense. "The energy directed by these [laser] weapons could travel across space essentially with the speed of light. This would be an invaluable characteristic for the interception of ICBM weapons and their decoys."

The Army is also thinking of laser uses, among them the "death ray" that has long fascinated science-fiction writers. The Army's death-ray gun would be small enough to be carried or worn as a side-arm — just like the "ray guns" of so many movies and adventure strips. Engineers at the Frankford Arsenal near Philadelphia are investigating a weapon which, presumably, would fire a light ray of enormous intensity, all but invisible because of its narrow (pencil-thin) breadth and its millionth-of-a-second speed. A soldier — continued on next page

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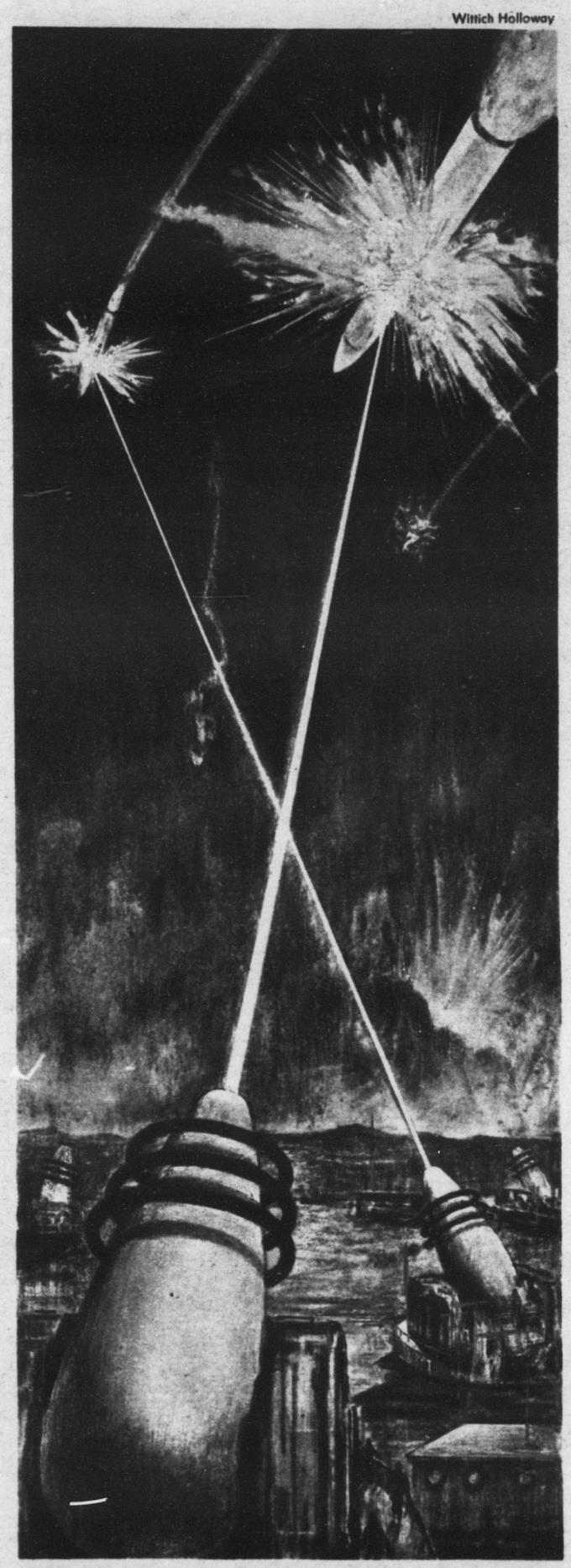
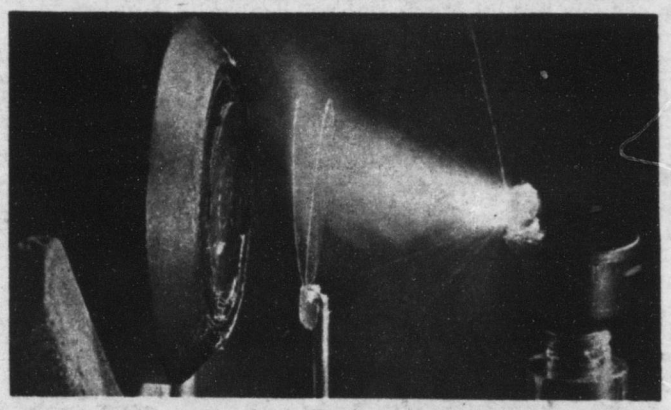
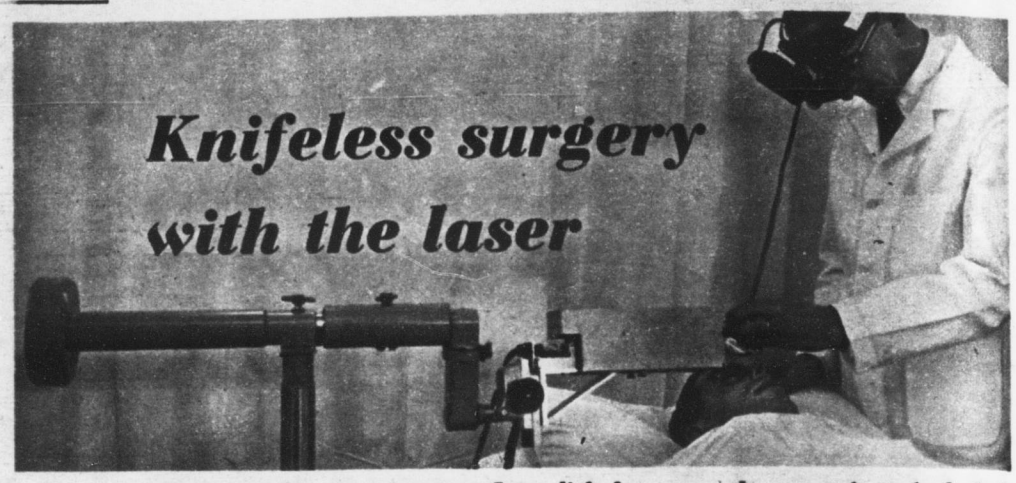




FORCE FOR WAR AND PEACE: *The same fantastic new power of the laser that can pierce a diamond in an instant (directly above) may be the key to speed-of-light missile killing (top)*



REVOLUTIONARY EYE OPERATION: *Laser light has removed a tumor in a single flash*

firing a laser gun would not give his position away with a report or flash.

Though Americans invented the laser, Soviet scientists have not missed its importance. The list of foreign laboratories working on laser development includes the Electric Lamp Works and the Lebedev Physical Institute in Moscow. Most American scientists take it for granted that the Soviet Union is trying to match us in laser development as in every other phase of technology that has important military applications.

So far the U.S. government has appropriated about $16 million for laser research and, though the laser has perhaps even greater use as a peaceful tool than as a weapon, the Army, Air Force and Navy are spending 95 per cent of the funds. The armed services have commissioned more than 40 companies and universities to work on various phases of laser development. Many of the contracts are so secret, the inquirer cannot even find out what particular agency in the Defense Department awarded them, let alone what they are for specifically.

The moon shot

The most spectacular application of the laser so far actually made is the moon shot at Lexington, which may have as far-reaching consequences as that other "shot heard round the world" from the same region. The M.I.T.-Raytheon team operated their lunar flashlight last May 9. At 8:55 p.m. Professor Louis Smullin, head of the team, pressed a button at the end of a long rubber tube in a darkened observatory. A flash of light activated a ruby laser. A slender arrow of deep red light shot out of the device, through a telescope and into the cloudless skies. Exactly 1.3 seconds later, it lit up a two-mile-round section of the moon near the Albategnius Crater like a flashlight in a darkened room.

The event marked the first time man had illuminated another heavenly body. As if this was not a neat enough trick, 1.3 seconds after the light hit the moon, some of it bounced back across the 250,000 miles of space into another telescope at Lexington, completing the remarkable demonstration of the laser's power.

Another dramatic use of the laser came at New York's Columbia-Presbyterian Hospital. Working with an American Optical Co. ruby laser, the doctors flashed a ruby pulse one-thousandth of a second long through the lens of the eye of a patient. The single flash was aimed at a tumor on the retina, the rear wall of the eye on which images register. The tumor disappeared.

Brainstorm on a park bench

The laser and its forerunner, the maser, resulted from a brainstorm of Dr. Charles H. Townes, then a 35-year-old physics professor at Columbia University. It was one spring morning in 1951 and Dr. Townes was sitting on a park bench in Washington. He was thinking of the problems of microwave physics. The trouble lay in generating these extremely short radio waves. Suddenly it occurred to him that molecules of a gas could be stimulated to high-energy levels where, when a weak radio wave is fed into them, they would start vibrating at the same frequency as the weak signal wave, greatly amplifying it.

Dr. Townes, H. J. Zeiger, a research fellow, and James P. Gordon, a graduate student, made the idea work for the first time in 1954. Over coffee in the cafeteria of Columbia's Teachers College, they named the gadget "maser" — for Microwave Amplification by Stimulated Emission of Radiation.

At first, the maser was of only limited interest in scientific circles. However, one of its first uses was as an atomic clock to check Einstein's Special Theory of Relativity. (The maser clock showed that Einstein was right.) In 1958, Dr. Townes and his brother-in-law, Dr. A. L. Schawlow, who was at Bell Telephone Laboratories, suggested how to extend the maser principle into the visible light spectrum.

The laser is thus a kind of maser — one applicable to the visible light spectrum — while the maser may be used for invisible waves — ultraviolet and infrared as well as radio.

A growing field

In 1960, Dr. T. H. Maiman at Hughes Aircraft Co. demonstrated a laser for the first time. Since then, the field has not stopped growing.

Recently, Emil Rechsteiner and Robert L. Saxe of Technol- — *continued on page 25*

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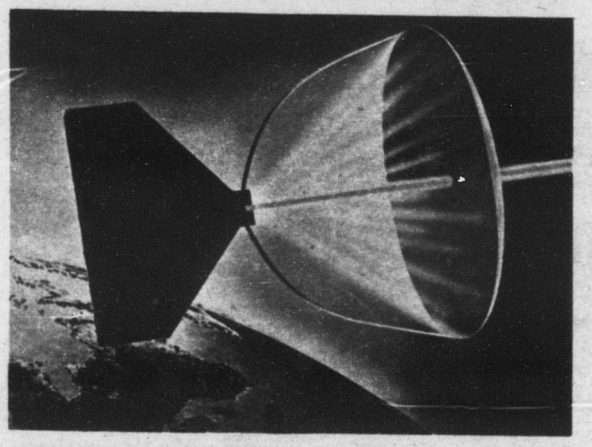
Ahead: missile killing rays, super-radar



SUN-POWERED *laser for inter-satellite communication*

ogy Markets, Inc., made an exhaustive study of the laser field. They reported:

"Potential applications in weapons, of course, have created intense interest in the Department of Defense. Large-scale funding for this purpose, however, still awaits results of basic studies now under way."

The two men reported that if all the promise for new weapons bears fruit, government and industry may be spending a billion and a quarter a year on lasers by 1970. That's three times the amount spent on the whole astronaut program.

Rechsteiner and Saxe predict these devices will have myriad military uses. They said battlefield radar sets built around lasers would be ready by 1964. These would discriminate tanks from trucks — not just supply nondescript "blips" as today's radar does.

In 1965, the men say, underwater radar, power transmission from earth to satellites (doing away with weighty batteries on board satellites) and radar for satellite-born missile detection systems will be tried. ***Lasers in satellites should make the Samos and Midas satellites and even the U-2 airplane cameras look like box Brownies in comparison.***

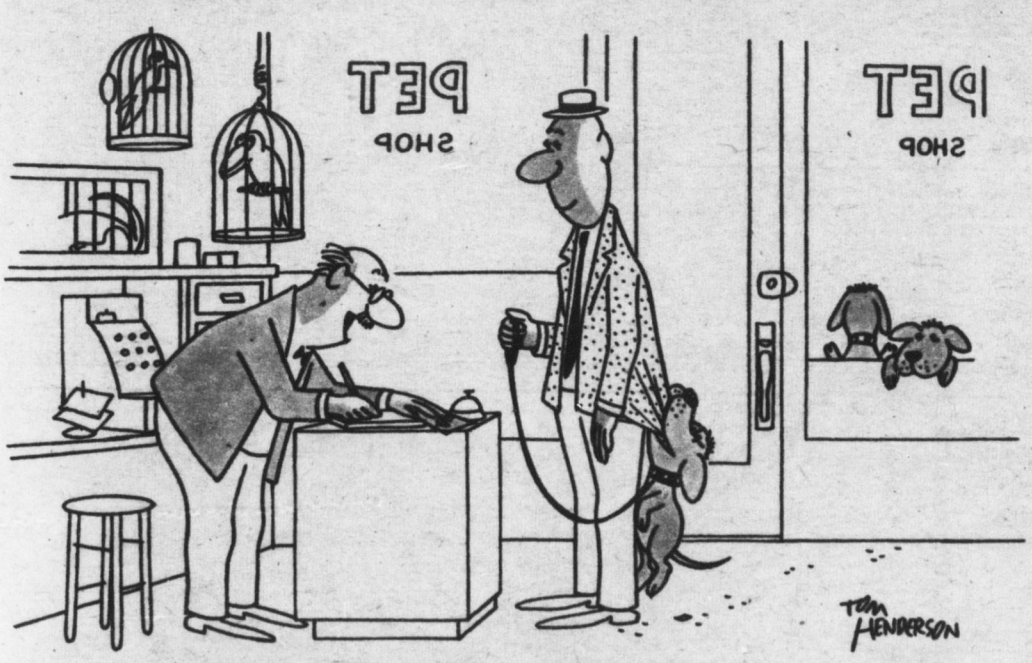
Finally, by 1966, the death-rays and anti-missile rays may be tried. The scientists are thinking of huge lasers, not unlike the anti-aircraft searchlights of World War II, that would roam the heavens, seeking out incoming missiles and destroying or diverting them with the powerful beams of light.

Bell Telephone Laboratories, where the transistor was invented, has well over a hundred of its experts working on laser projects. Hughes Aircraft and Technical Research Group is also doing heavy research.

The laser's future?

Meantime Dr. Townes, whose park-bench meditation created the maser-laser family, is convinced his brainchildren have tremendous undeveloped peaceful potential. "I think I might compare the laser with the vacuum tube," he told THIS WEEK. The vacuum tube, of course, was the original key element of radio and the whole modern electronics industry. "The laser will have uses comparable with, or even greater than the microwave technology," he added. The microwave is the basis of radar transmission. One use Dr. Townes and other scientists foresee is a sun-powered laser for jam-free space communications. Another will make possible an enormous multiplication of TV channels.

The laser is still in an early enough stage for scientists to turn toward development of killer rays or toward beams of hope. Which way they will turn depends most of all on the course of the Cold War. This new Aladdin's Lamp can burn and destroy, or shine, illuminate and cure. —THE END



"You picked a good frisky one"